April 2018

Trading the VIX: How to Beat the Stock Market

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TRADING THE VIX: HOW TO BEAT THE STOCK MARKET

BY

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INTERACTIVE QULIFYING PROJECT SUBMITTED TO DIMITRIOS KOUTMOS
WORCESTER POLYTECHNIC INSTITUTE

APRIL 2018

Abstract

The purpose of this paper is to outline the Interactive Qualifying Project (IQP) which I researched during the fall of 2017 (A-Term). In this paper, I will go through the process I took to establish a method of trading profitably using the VIX. To start, I will give a brief outline of what an IQP is and the project I chose, as well as why I chose this topic. Within this introduction I will introduce my research and the findings as well as implications from a broad stand point. From there I will then move into back ground research which is essential the research I did during A term to complete this project. Next, I will go into the data and break down exactly what the data means and how I utilized the information and transformed it to make the data more compatible with the method I used to trade on the VIX. Finally, I will break down my major findings and recommendations on where to invest and when to invest if you are an eager investor considering getting into the market.

Introduction

My name is Erik Fyrer, I am a Junior at Worcester Polytechnic Institute where I am studying Business. This year I started my IQP which involves interpreting the Volatility Index (referred to as VIX) and trading using these interpretations. Before explaining my project, I will explain what the IQP is in general. To quote directly from the WPI website, "The Interactive Qualifying Project (IQP) is one of the most distinctive elements of the WPI Plan and WPI's signature project-based curriculum, giving every WPI student the experience of working in interdisciplinary teams to solve a problem or need that lies at the intersection of science and

society."[1] Being alive for a very interesting economic time period, where people lost a significant amount of money in the crash and now have made a significant amount of money in the boom, made me interested in developing a way to essentially beat the market and always be profitable in the end. The main goal of the project was to find a window of opportunity in the market to maximize profit while also minimizing risk.

To start out I needed to identify which individual ETF's and stocks I would use to evaluate against the VIX. After careful consideration, I decided to go with mostly funds and major stocks which many people and companies invest in. The funds and stocks I ended up choosing were: SPDR S&P 500 ETF Trust (SPY), iShares S&P 500 Index ETF (IVV), Vanguard Total Stock Market ETF (VTI), iShares MSCI EAFE Index Fund ETF (EFA), Vanguard Emerging Markets Stock Index Fd (VWO), Vanguard Tax-MA FTSE Developed MKTS (VEA), Power Shares QQQ Trust, Series 1 ETF (QQQ), iShares Barclays Aggregate Bond Fund (AGG), iShares Core S&P Mid Cap ETF (IJH), Cop Sync (COYN), Amazon (AMZN), and Nike (NKE). After choosing the stocks I went to YAHOO Finance and downloaded all the data for each one of these funds and stocks. Along with downloading this data I also downloaded the data from the VIX so I had the ability to compare all the data on one spreadsheet. I simply trimmed down the data from the funds/stock and VIX to start and end on the same date which ended up giving me a range from 2007 to 2017 (about 10 years). It was important to my research and credibility of this trading method to include the 2008/09 recession to prove to readers this method even holds up during times like this and can even prove to be more successful during these times.

[1] https://www.wpi.edu/academics/undergraduate/interactive-qualifying-project

After setting up a spreadsheet with all my data on it, I erased all data except the closing price for each fund and stock and then added two columns per stock/fund called return and % Return. I simply derived values for the return column for each fund and stock by taking the next recorded value subtracting the previous value and then diving that number by the same previous value. After doing this I determined I would need to multiply this number by 100 to make the data easier to maneuver and understand as well as turn this into a percent which is how returns and things of that nature are calculated. The third column % Return was later found when establishing a buy and sell window for each stock and fund and then using the same equation as the return column, which is just ((sell price – buy price) / buy price) * 100.

After the conclusion of the research I could find a window of opportunity which in my opinion limited the risk and maximized the reward. This window was an interval on the VIX between 20 and 40. I determined the **buying value at 40 or above on the VIX** and the **selling point as 20 or below on the VIX**. I could consider expanding this window but would most likely only move the sell point down to 15 but could move the buy point up to 50. The reasoning behind this is because you are not yet invested prior to the buy point and by increasing that you are only increasing your chance of a higher return. On the contrary, decreasing the sell point too much can put you at risk because the VIX is not something which is easy to predict and decreasing your selling point too low gives the market a chance to recover and autocorrect itself, or even crash, which would lead to you losing your investment and not profiting at all. In terms of my data you will see major profit margins on all but one of my investments. I believe this is the case because with the stock COYN you see the stock start as a penny stock and then become traded

on the NYSE and then more recently become a penny stock again losing all its value causing our data to be skewed for this individual investment.

From my data and research there are many implications which are important for traders of all experiences to consider. In the current market, we have seen record setting values for many stocks and securities. Along with these record high prices we are seeing record low values when looking at the VIX. The period we are in now is most certainly a sell period, however when determining to sell you need to have some intuition and realized if we are setting new record lows for the VIX, meaning prices are still trending upward then maybe you should ride out this wave until you see the market start to collapse. That being said, this is a risky move because looking at past market failures it is almost impossible to predict. However, this is the reason I am writing this paper and choosing to do this project on the market. From my research below you will see insight on how to beat the market and how you can use a version of the methodology I have which is suitable for you and maximize your returns.

Background Research

Before doing a research project on a tool which I believe to be very useful in terms of beating the market, I needed to fully understand the VIX and understand some common misconceptions people have about the VIX. While looking into different articles, journals, and readings, I found one which was particularly interesting. This article was VIX: Fact or Fiction which was a paper on five common myths regarding the VIX researched by the Research Department of the Chicago Board Options Exchange. Although a few of their supposed myths may be worked against this research I conducted, one thing stood true, and this myth is one of the reasons why I

believe this method to be so useful. Many people believe the VIX is a current measure of volatility in the market. However the VIX is really a measure of future volatility which means it may or may not come to fruition. However, in 2008 the VIX reached a record high of about 80 meaning the volatility had increased leaving traders a hint which way the market was going, down, hence the inverse relationship (most of the time). [2] It was this inverse relationship and ability to predict and react to the VIX in terms of the market which helped inspire me to complete this project.

Prior to this project I had grown interested in the market and making and losing money in the market. We often hear of major success stories such as Warren Buffett along with other major investors who started from nothing and now are some of the wealthiest people in the world. There's also the new phenomena of Bitcoin and crypto currencies where we are hearing of even more overnight millionaires who bought in to these currencies years ago. However, the one thing all of this big time investors have in common is time. Most wealthy investors invested years ago when the markets were at the bottom and had the most potential for growth and profit. Being a millennial where it seems most millennials focus is on making money and making money now not in the future. This desire for money which is a common trend inspired me to come up with a way to beat the market, which according to many academics is not possible. Malkiel (2003) talked the efficient market hypothesis, and how there is no way to explain or predict stock price changes.[3] However, my project is seeking to explain the stock price using the VIX.

[2] Research Department CBOE. "VIX – Fact & Fiction." Chicago Board Options Exchange, no. 2, 1 May 2009.

[3] Malkiel, B. G. (2003). The efficient market hypothesis and its critics. *Journal of economic perspectives*, *17*(1), 59-82

Because of this common desire I wanted to figure out a way to enter the market as the stock market whether you day trade or buy and sell on a more long term basis is the best way in my opinion to make money on a larger scale. It's quite obvious we are currently in a boom which means entering the market although would still be profitable in the long run, is the not the wisest of moves as you would need to invest a mass amount of money in order to reap the profits which won't pay out until after the market falls and then rises in most likely the next 10 years. Because of this desire I decided to figure out a strategy which will give me a timeline on when to invest in the market and when to pull out of the market in order to make the most money. From this desire I looked into tools people use to beat the market and found an article from the WSJ on the VIX which made me decide this is the tool I wanted to use. The following sentence is what gave me the final convincing of this is the right tool to use: "The measure was created in the aftermath of the Black Monday crash in 1987, but it really gained traction after the financial crisis in 2008, when its rapid surge was credited for anticipating the market crash".[4]

Realizing there might have been a way around the crash of 2008 and finding out many people actually made millions of dollars when the market was at its worst, inspired me to look more into the VIX and its correlation with the S&P 500 to see if other people had written papers with similar strategies. One paper in particular stood out, Kiran Manda wrote a paper titled Stock Market Volatility During the 2008 financial crisis where she said, "During this time (referring to the crash), the S&P 500 lost about 56% of its value from the October 2007 peak to the March

[4] https://www.wsj.com/articles/vix-101-how-the-volatility-gauge-works-1524398401

2009 trough and the VIX Index more than tripled, highlighting the leverage effect that Black (1976) described in his paper on the study of stock market volatility".[5]

The research started in A term like stated above involved 9 large funds and 3 individual stocks. The reason behind choosing the funds over all stocks is because after doing research and talking to people who have portfolio's through brokers or other companies, it seems they are currently investing in funds rather than stocks. However, I did include three stocks as I am personally interested to see if this method works for stocks I am interested in, or companies I have looked into. In my research you will see three different kind of figures, the first being the price of the funds or stocks tracked over time, the second being figures that compare prices to the VIX on the same graph giving us the ability to spikes and falls in the VIX and how that correlates, and the third is the correlation between the funds and the VIX.

Data

The graphs and charts you will see in this section were derived from a spreadsheet of data described above. I found all the price data for the 12 stocks or ETF I chose to evaluate on YAHOO Finance. I then trimmed the data to make all of the data align to the same starting and ending point to directly line up with the VIX data which is premise of my theory. I then related a column for each set of data called ret (i.e. – 'etfret') which was just the difference between the nth value and the n-1 value. From there I developed another column which was the % return of each stock or fund and these values are only used when you have a buy and then sell date which completes the cycle giving you the ability to calculate your profit and what % you yielded from

[5] Manda, Kiran. "Stock Market Volatility during the 2008 Financial Crisis." The Leonard N. Stern School of Business, April 1, 2010, 1-3.

the initial investment. Without providing the entire spreadsheet in this paper I needed a way to present the price data of each security which is why I have the two charts below. Chart 1 is a description of the securities used in this experiment and Chart 2 is the summary statistics of the data.

Fund	Ticker	Description
Spydr ETF	SPY	The SPDR S&P 500 ETF tracks a market-cap-weighted index of US large- and midcap stocks selected by the S&P Committee.
iShares ETF	IVV	The iShares Core S&P 500 ETF tracks a market-cap-weighted index of US large- and midcap stocks selected by the S&P Committee.
Vanguard ETF	VTI	The Vanguard Total Stock Market ETF tracks a cap-weighted index that measures the investable US equities market, encompassing the entire market-cap spectrum
ishares MSCI EAFE ETF	EFA	The iShares MSCI EAFE ETF tracks a market-cap-weighted index of developed-market securities based in Europe, Australia and the Far East.
Vanguard Emerging Markets Stock	VWO	The Vanguard FTSE Emerging Markets fund tracks a market-cap-weighted index of emerging-market stocks, excluding South Korea
VNG FTSE MrkETF	VEA	The Vanguard FTSE Developed Markets ETF tracks a market-cap weighted index of large-, mid- and small-cap stocks from developed markets outside the US.
Power Shares ETF	QQQ	The QQQ is an ETF that trades on the Nasdaq and tracks theNasdaq 100 Index.
iShares Barclays Aggregate Bond Fund	AGG	The iShares Core U.S. Aggregate Bond ETF tracks an index of US investment-grade bonds.
iShares Core S&P Mid Cap ETF	IJH	IJH is one of the oldest US midcap ETFs and, like competitors IVOO and MDY, tracks the S&P MidCap 400 Index.
Copsync	COYN	COPsync Network, a software as a service, which enables patrol officers to collect, report, and share critical data in real-time at the point of incident.
Amazon	AMZN	Amazon.com, Inc. engages in the retail sale of consumer products and subscriptions in North America and internationally.
Nike	NKE	NIKE, Inc., together with its subsidiaries, designs, develops, markets, and sells athletic footwear, apparel, equipment, and accessories worldwide.

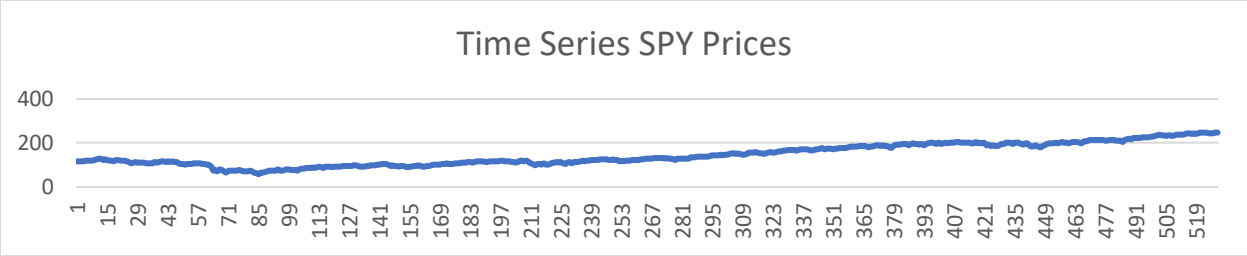
Chart 1 – Description of all securities used in experiment

Ticker	Mean	St. Dev	Skew	Kurt
AGG	0.0840	0.7669	-3.4462	64.8490
AMZN	0.4671	4.8427	0.4671	2.6077
COYN	1.2921	16.3359	1.2921	8.2946
EFA	0.0764	2.9792	-0.7115	5.4246
IJH	0.2041	2.9705	-0.2642	5.6307
IVV	0.1801	2.6264	-0.6491	-0.6491
NKE	0.0840	3.7252	0.0622	4.0397
QQQ	0.2643	2.7433	-0.3989	2.8545
SPY	0.1737	2.5676	-0.6920	9.3107
VEA	0.0847	2.9532	-0.6893	5.4036
VTI	0.0764	2.9792	-0.7115	5.4246
VWO	0.1109	3.6668	-0.1056	6.3602

Chart 2 – Summary Statistics of all securities used in experiment

In chart two you see the Mean, which is the mean return of the certain security from a day to day basis (i.e. – for AGG you see a 0.0840 average return) followed by the Standard Deviation of the return and the Skew and Kurtosis as well. This data is extremely interesting because if you notice all the means are in the positive which then in returns means on average all of the funds or stocks I chose are increasing on a day to day basis leaving a high chance of profitability for the trader(s).

The next section of figures in comprised of graphs which are simply to display the change in price in each security. This is also known as the ticker for these induvial stocks or funds. It is important to note the general upwards trend in most of the graphs which shows our economy is always trending upwards and is growing.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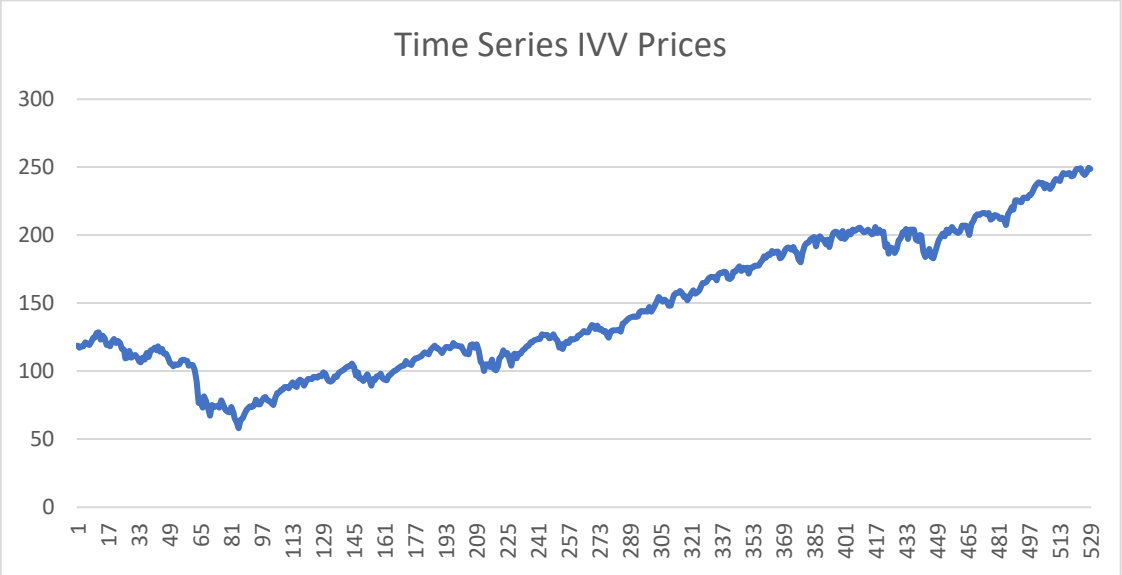
Time Series IVV Prices
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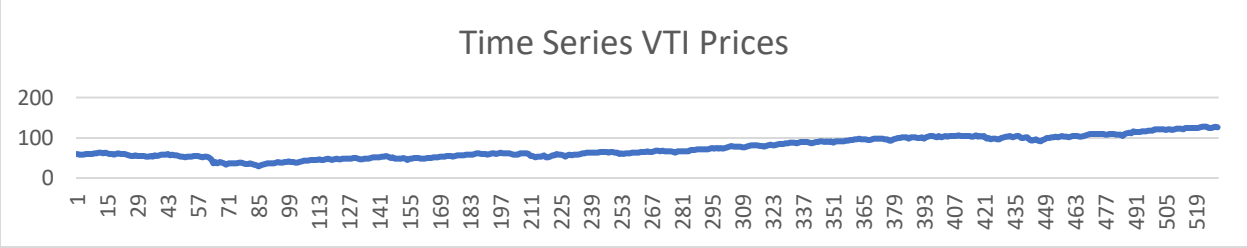
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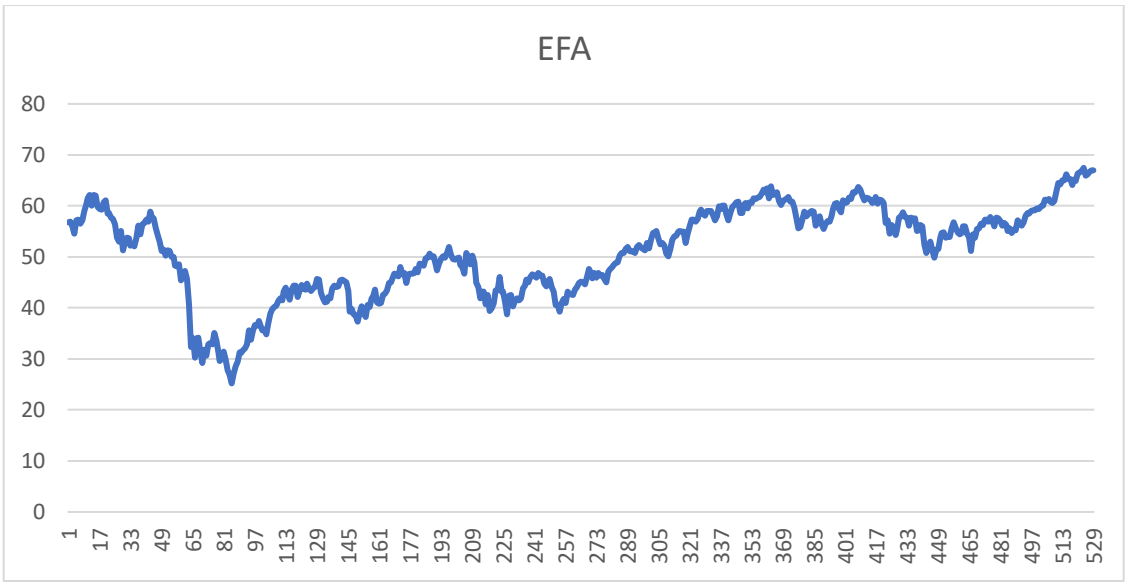
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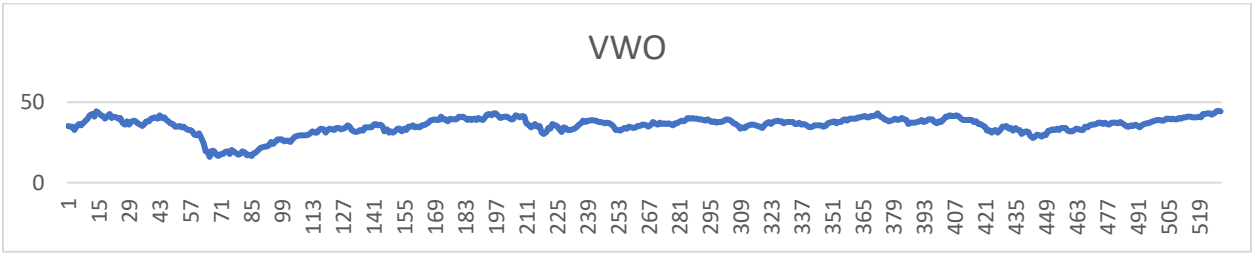
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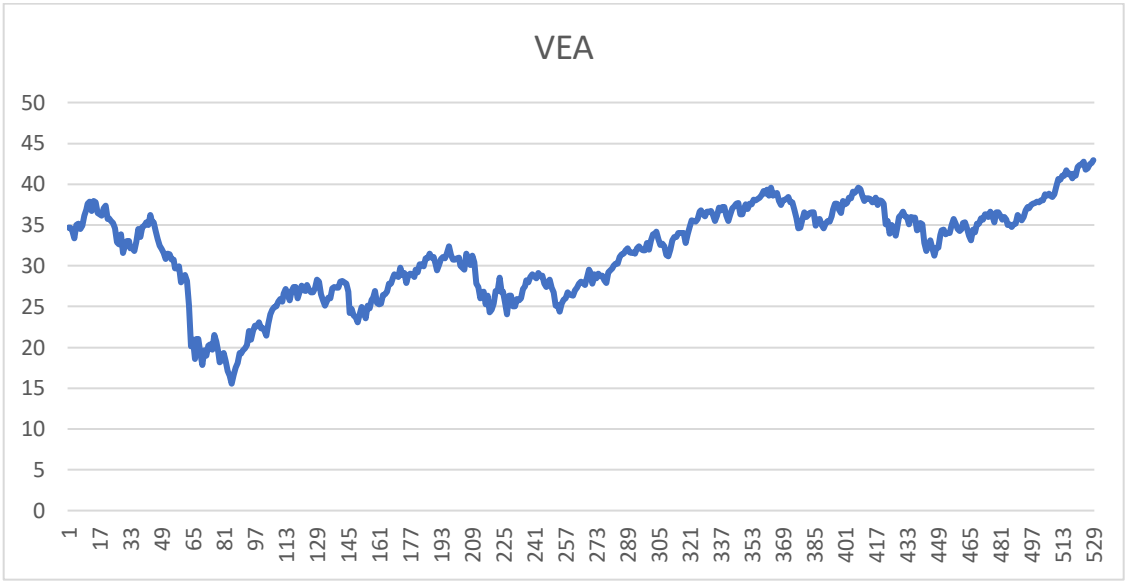
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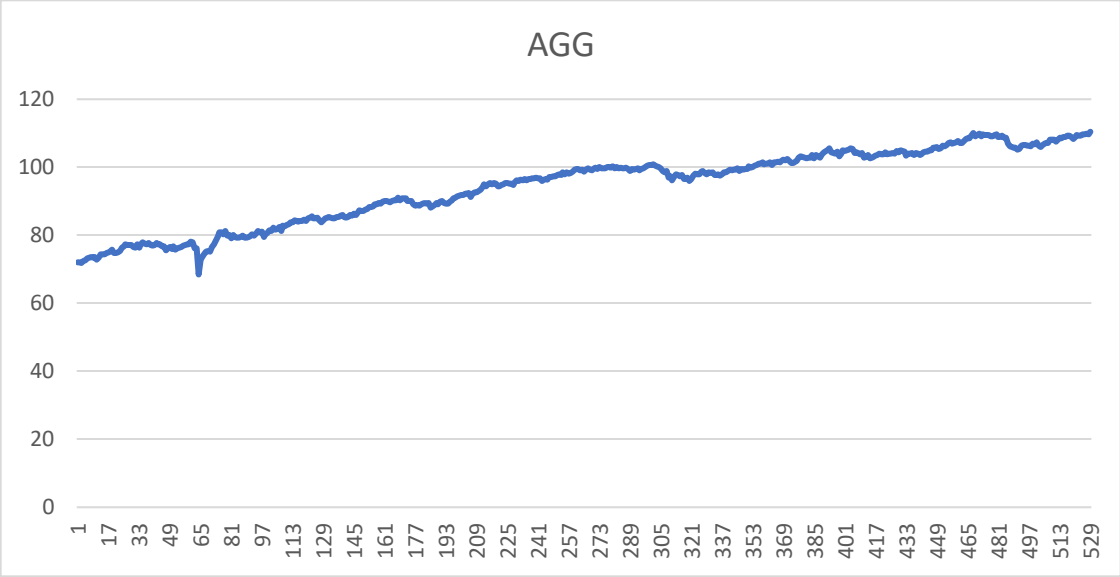
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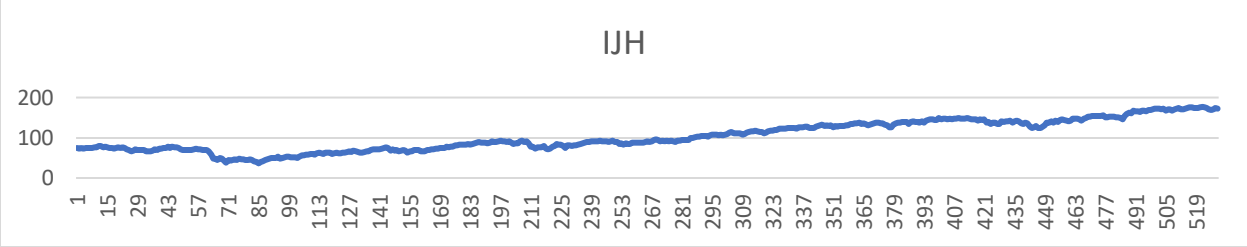
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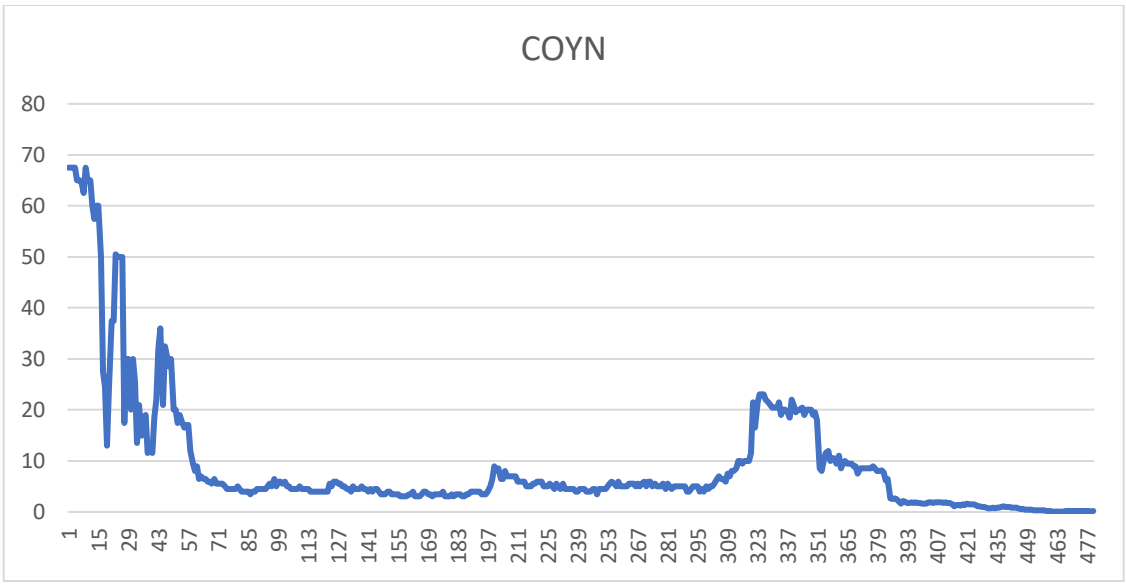
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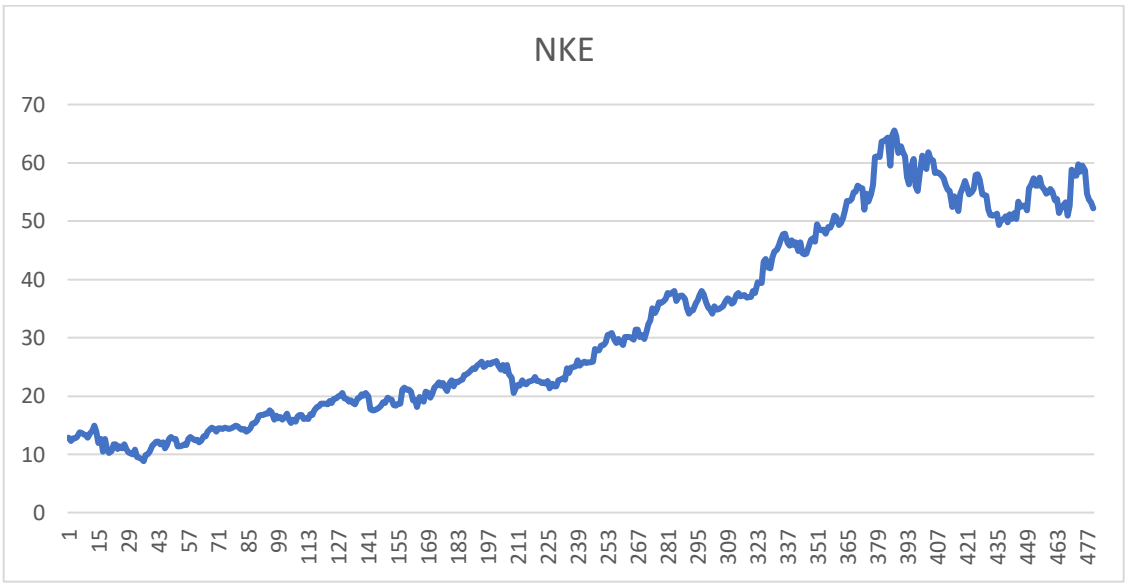
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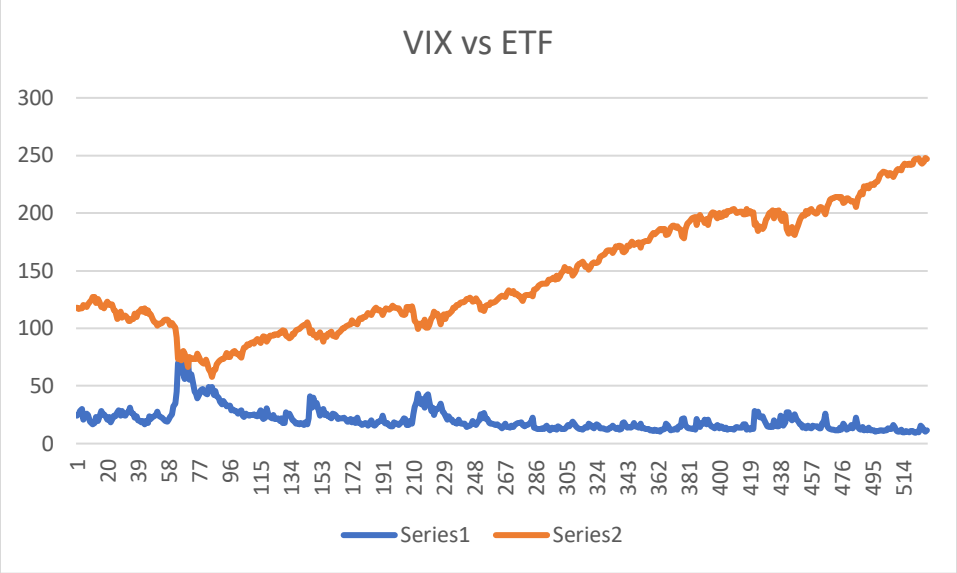
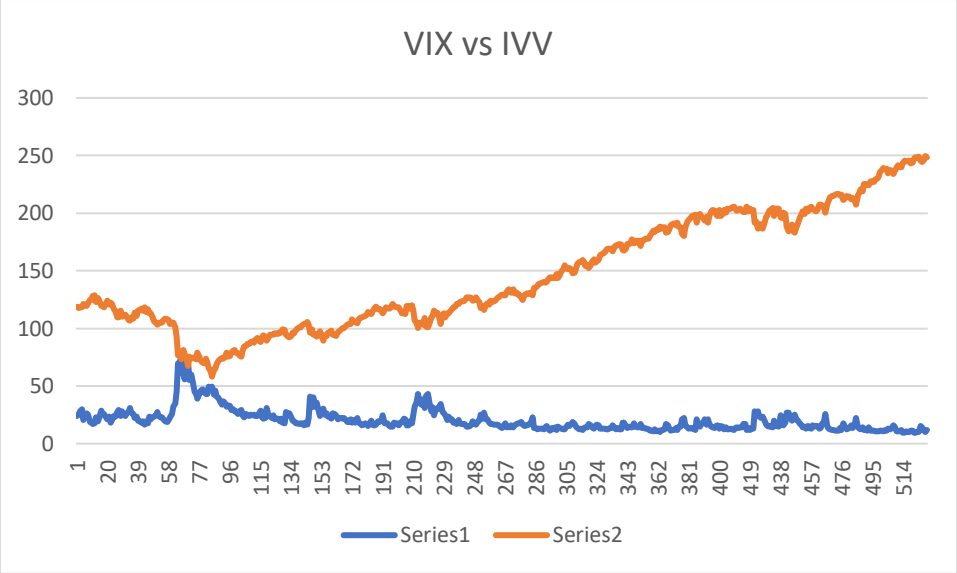
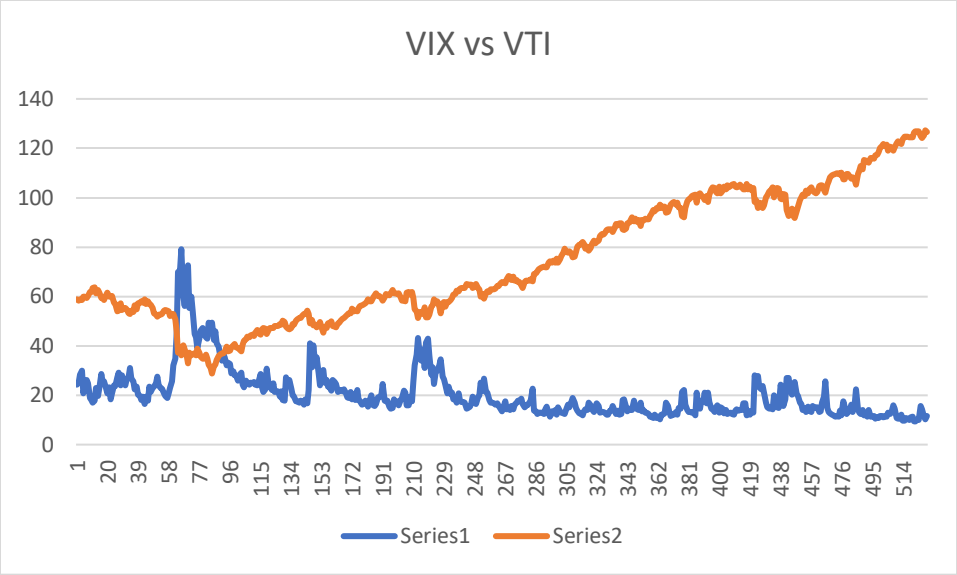
The last section of graphs is now overlaying the VIX which will be seen in blue on the next graphs with the tracking of the price in orange. Please be careful to notice the inverse relationship displayed in most of the graphs you will see below, which is a key attribute in proving this trading method to be successful which will be talked about in a later section of the paper.






VIX vs VTI
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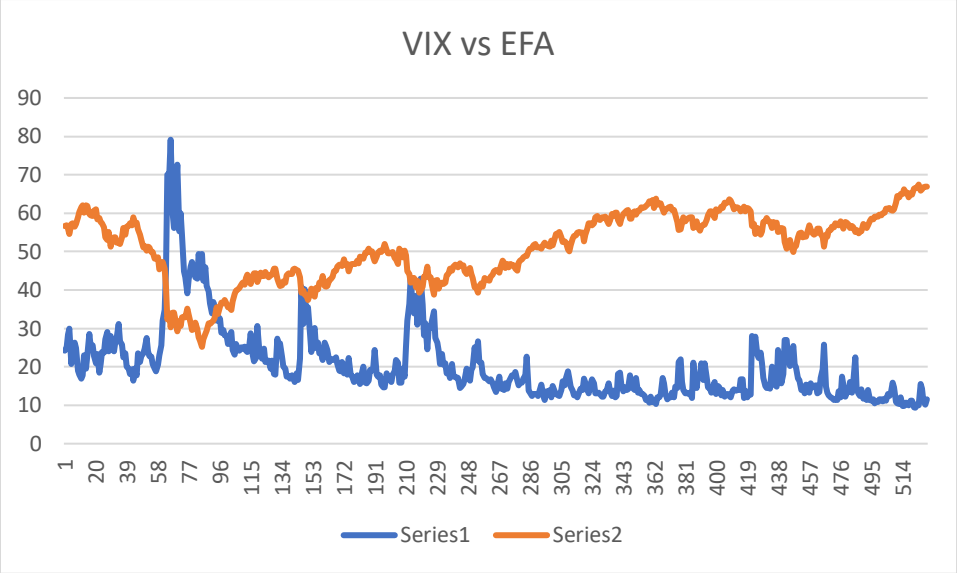
Series1
Series2


VIX vs EFA
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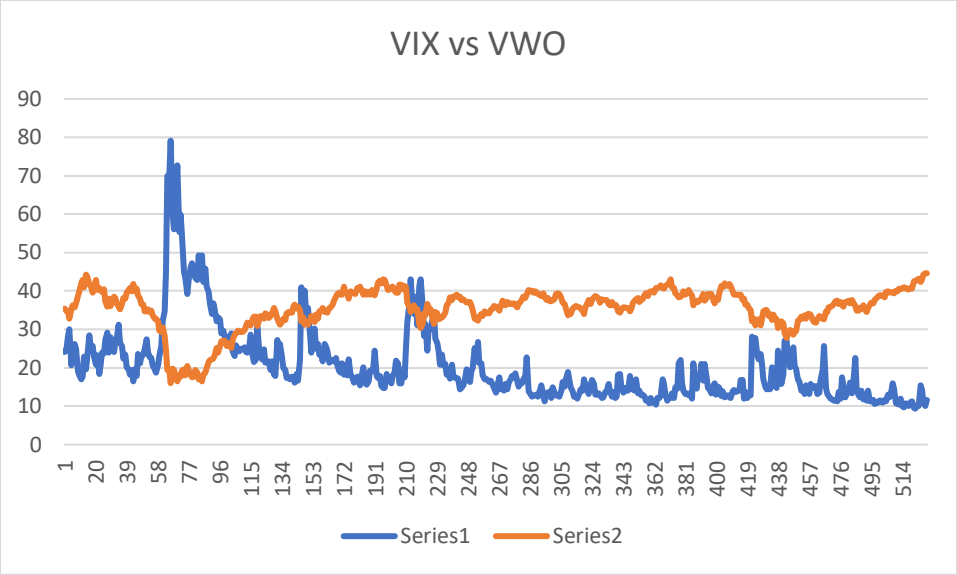
Series1
Series2


VIX vs VWO
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70
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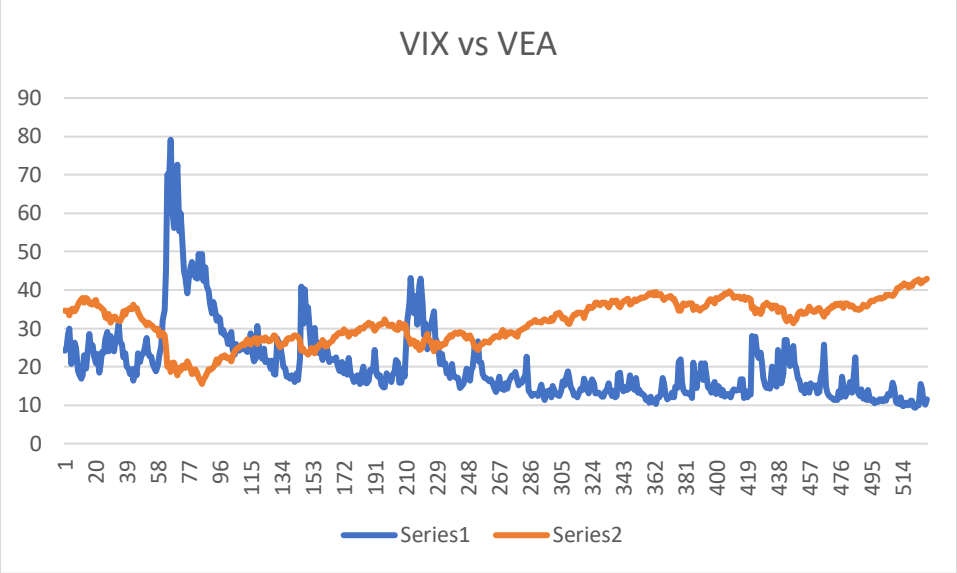
Series1
Series2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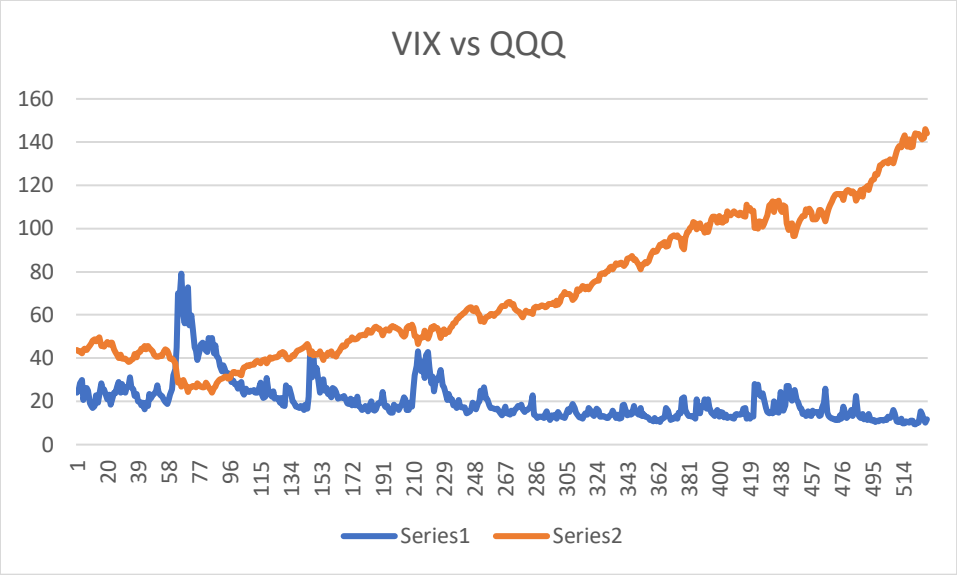
Series1
Series2


VIX vs QQQ
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140
120
100
80
60
40
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0
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Series1
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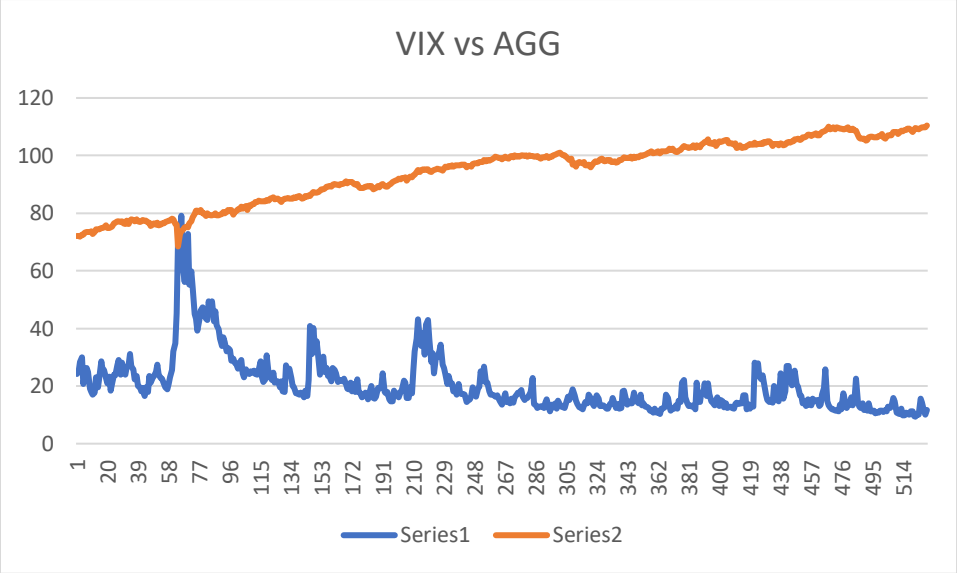
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Series1
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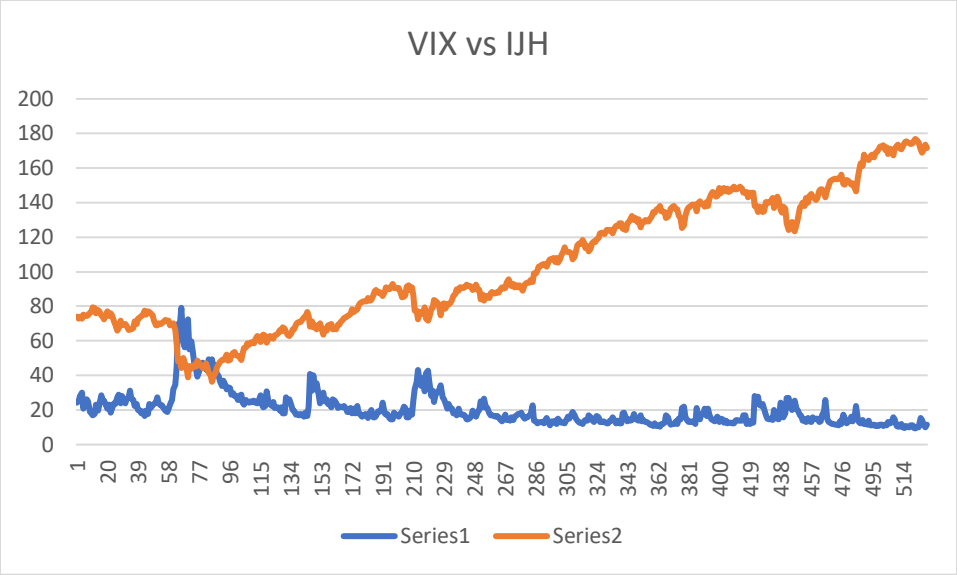
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Series1
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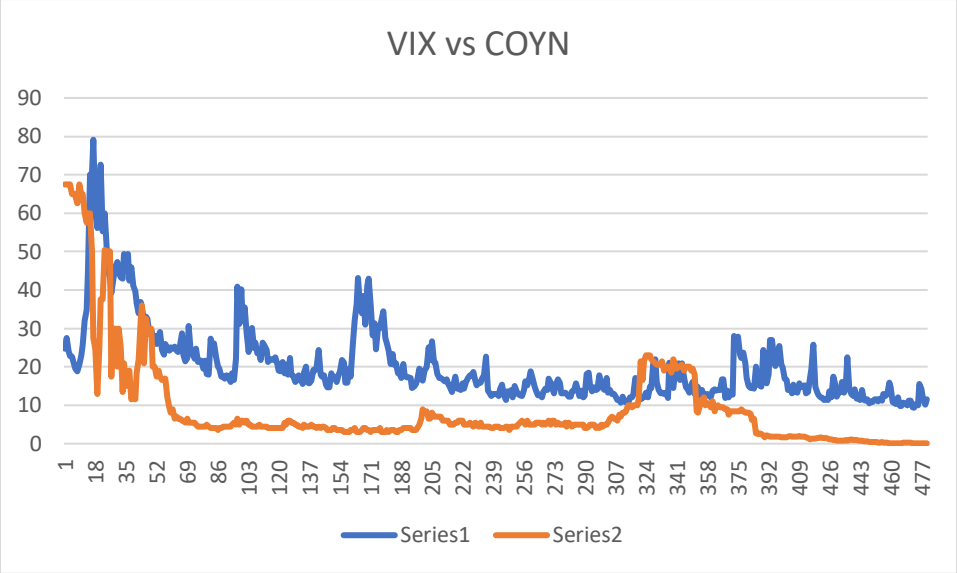
VIX vs COYN
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154
171
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375
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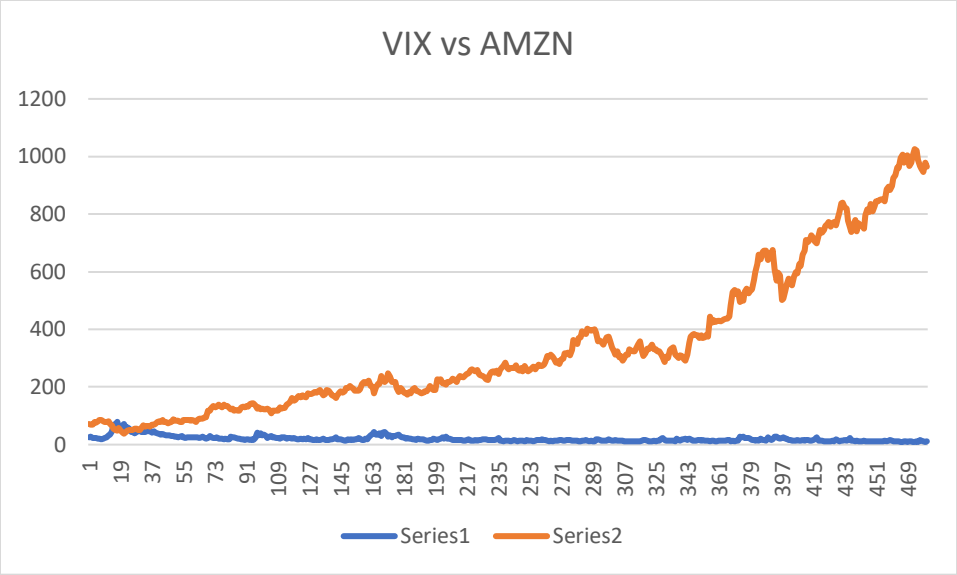
477
Series1
Series2


VIX vs AMZN
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1000
800
600
400
200
0
1
19
37
55
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91
109
127
145
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199
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Series1
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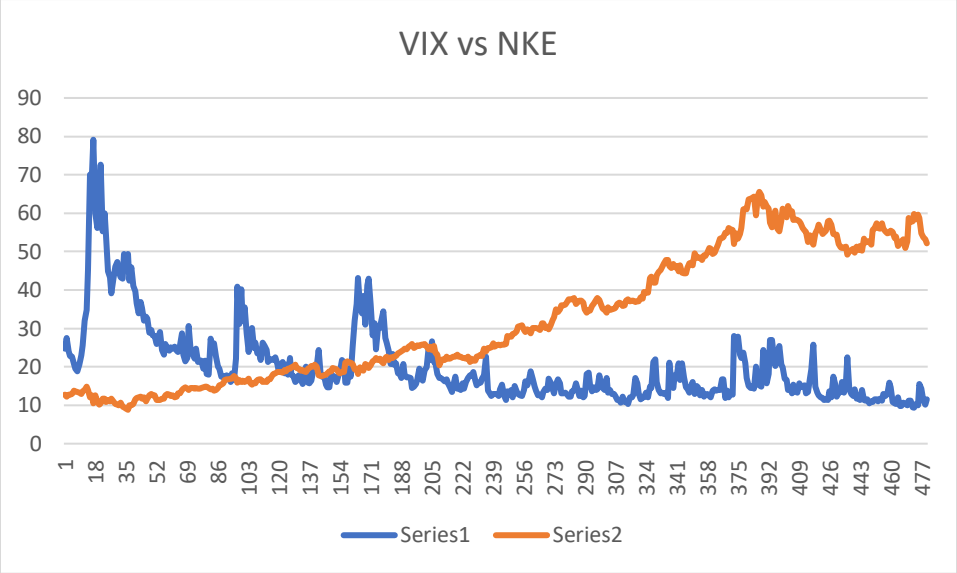
VIX vs NKE
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154
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205
222
239
256
273
290
307
324
341
358
375
392
409
426
443
460
477
Series1
Series2

Date	Buy/Se	VIX	SPY ETI	IVV ETI	VTI ETI	EFA ETI	VWO ET	VEA ETI	QQQ ETI	AGG ETI	IJH ETI	COYN	AMZN	NKE
9/29/08	Buy	$ 45.14	$ 91.86	$ 92.29	$ 45.91	$ 40.66	$ 24.40	$ 25.12	$ 33.04	$ 76.07	$ 58.14	$ 60.00	$ 67.00	$ 13.90
12/21/09	Sell	$ 19.47	$ 96.58	$ 96.90	$ 48.89	$ 43.90	$ 33.43	$ 26.78	$ 42.29	$ 84.40	$ 66.34	$ 4.50	$ 138.47	$ 14.68
	Return		5%	5%	6%	8%	37%	7%	28%	11%	14%	-93%	107%	6%
5/3/10	Buy	$ 40.95	$ 95.93	$ 96.55	$ 49.08	$ 39.23	$ 32.02	$ 24.22	$ 41.81	$ 85.88	$ 68.35	$ 6.50	$ 124.98	$ 15.95
10/11/10	Sell	$ 19.03	$ 102.51	$ 103.35	$ 52.74	$ 46.66	$ 39.54	$ 28.94	$ 47.70	$ 90.36	$ 74.51	$ 4.00	$ 164.64	$ 18.66
	Return		7%	7%	7%	19%	23%	19%	14%	5%	9%	-38%	32%	17%
8/15/11	Buy	$ 43.05	$ 99.54	$ 100.38	$ 51.18	$ 41.87	$ 34.56	$ 26.00	$ 46.61	$ 94.96	$ 72.39	$ 3.00	$ 178.93	$ 18.08
1/16/12	Sell	$ 18.28	$ 117.95	$ 118.43	$ 60.61	$ 43.86	$ 36.21	$ 27.15	$ 56.00	$ 96.09	$ 85.89	$ 3.00	$ 190.93	$ 23.59
	Return	18%	18%	18%	18%	5%	5%	4%	20%	1%	19%	0%	7%	30%
Average Ret.		10%	10%	11%	11%	11%	22%	10%	21%	6%	14%	-44%	48%	18%

Chart of all Trades executed during the time period

Major Findings

The first major finding from the research conducted regarding the VIX and each different fund or stock is how the VIX and each stock or fund have an inverse relationship. This means as the VIX increases, or volatility increases amongst the people, the stock price will decrease which is indicated by a high VIX meaning a buy period in my strategy I developed. Inversely, when the VIX goes down, people are feeling good about their stock values and will not be trying to sell off, however according to the research above, this is when you should sell as this is usually directly correlated with higher prices then when I recommend buying.

Going through the excel spreadsheet which indicates the buy and sell periods for each fund and stock, on average for the funds I used which can be found above, the return is 12.65%. It is important to know in this section using my trading method there were no funds which I would have invested in which gave you a negative return. The highest return was about 21% and that was for the VWO ETF which had three returns of 37%, 23%, and 4%.

The other kind of area I chose to invest in was in individual stocks. Like stated earlier I chose three stocks, COYN, AMZN, and NKE. According to the same excel spreadsheet, on these three stocks, investing when recommended by my strategy I averaged a return of 7.47%. In these three stocks, this average return is a little skewed because with the stock COYN the return was -43% because it went from a penny stock to a regular stock and then dropped value back down to a penny stock. If I were to recommend this strategy to people I would only recommend investing in stocks which are established and do not have as much unknown as stocks such as the COYN stock. Taking the COYN stock out, the average increases from 7.47% to 33.04% which is an unbelievably good return on any investment in the stock market.

Conclusion

To conclude this experiment and write up, I want to first speak to the success of this trading method and acknowledge I am not the first person to implement a trading strategy involving the VIX. As you may have noticed by the major findings other than one outlier this method of trading has proven to be very successful in the past, using real data. That being said, it is important to note the stock market according to some people is unpredictable and playing the market can be seen as a zero sum game. However I am confident using this strategy, with the mass amount of data which helped prove it, you could beat the market and be a successful trader with little background knowledge.

During this experiment there were times I wished I had changed a few of the ways I went about creating intervals, choosing where to invest and etc. If I were to run this experiment again I would go with a more risk-loving approach and increase the interval to hopefully maximize my profits while also increasing the chance of trading negatively. Another area I would have changed was to add more stocks as those seem to be the securities people are able to invest in the easiest without a broker or a paid for platform to invest.

Overall, this experiment and paper portray a great trading strategy for the average trader and beyond. Anyone with no experience or anyone with years of experience could benefit from reading this method and changing the buy/sell window according to their liking. From a general standpoint of the point of an IQP, I believe this project was a success. This project gave me the chance to look into data I would probably never have done on my own time, and develop a

trading method which I can now use as well as share with people I look to work for in the future. An unintended consequence of this IQP was for me to meet a faculty member and give me a chance as a transfer student to branch out and not just skate by without making some personal connections at this school.